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ABSTRACT

The infant mortality rate in the District of Columbia is higher than that for any other state. This high rate stems from the great number of infants born seriously underweight and reflects the area's high percentage of births to impoverished black women. Efforts to reduce the mortality rate have centered around the medical treatment approach, which attempts to improve the underweight infant's chances of survival. This approach has several disadvantages for the infant, including risk of death, the possibility of physical handicaps and learning disabilities, increased illness, and parental abuse and neglect. This method also is quite costly to the public. Alternatively, the problems of underweight infants could be alleviated by a preventive program to reduce the incidence of premature birth. Although barriers to such a program exist and identification of the specific factors which reduce low birth weight and infant mortality is difficult, the success of preventive approaches to reducing infant mortality has been documented in several studies. A low-cost preventive program targeted by geographic area and limited to low-income women at high risk is necessary and feasible, but policy and coordinated community action to prevent prematurity is also required. (Nineteen tables provided in the text and appendices present pertinent data concerning infant mortality; a selected bibliography is also given.) (RH)

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The Prevention of Prematurity:

A Strategy to Reduce Infant Mortality in the District of Columbia

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Preface

This policy paper makes the case for greater efforts to reduce infant mortality in the District of Columbia through a program to prevent prematurity. It is a new look at an old problem that has troubled the District for many years.

The paper grew out of the research done for the Greater Washington Research Center's Task Force on Local Government Response to Fiscal Pressure. An educational and development program based on the ideas outlined here has received generous special funding from The April Trust and from The Corina Higginson Trust. These funds have also paid for the publication of this report.

Together, the final report of the Task Force and the research papers prepared in connection with the Task Force project, including this one, comprise the Research Center's second State of the Washington Region Report, a report made possible by a major grant from the Eugene and Agnes E. Meyer Foundation. Additional funding for the Task Force on Local Government Response to Fiscal Pressure has been received from:

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Atlee E. Shidler
President
Greater Washington Research Center

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Six people strongly influenced my thinking on this topic: LaSalle D. Leffall, Jr., M.D., Chairman of the Department of Surgery at Howard University Hospital, Harry Huge of Rogovin, Huge & Lenzner, and Mary Ann Stewart, all of the Task Force on Local Government; C. Arden Miller, M.D., Chairman of the Department of Maternal and Child Health at The University of North Carolina; Charles Miller of the National Institute of Medicine; and Ruby Van Croft, R.N., Assistant Director for Services of the Visiting Nurse Association of Washington, D.C.

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Onita Terrell and Barbara Middleton retyped this paper several times, each time carefully and efficiently.

Based on many comments received on earlier drafts, I rewrote this paper extensively just prior to publication. Few people have seen it in this, its final form, and it is therefore particularly important to note that any and all errors are mine alone.

Joan Maxwell

SUMMARY

In order to reduce infant mortality in the District of Columbia, improve the quality of life for newborns and their families, and save public and private funds, this paper recommends a program to lower the number of seriously underweight infants born in the District.

The Problem of Infant Mortality in the District

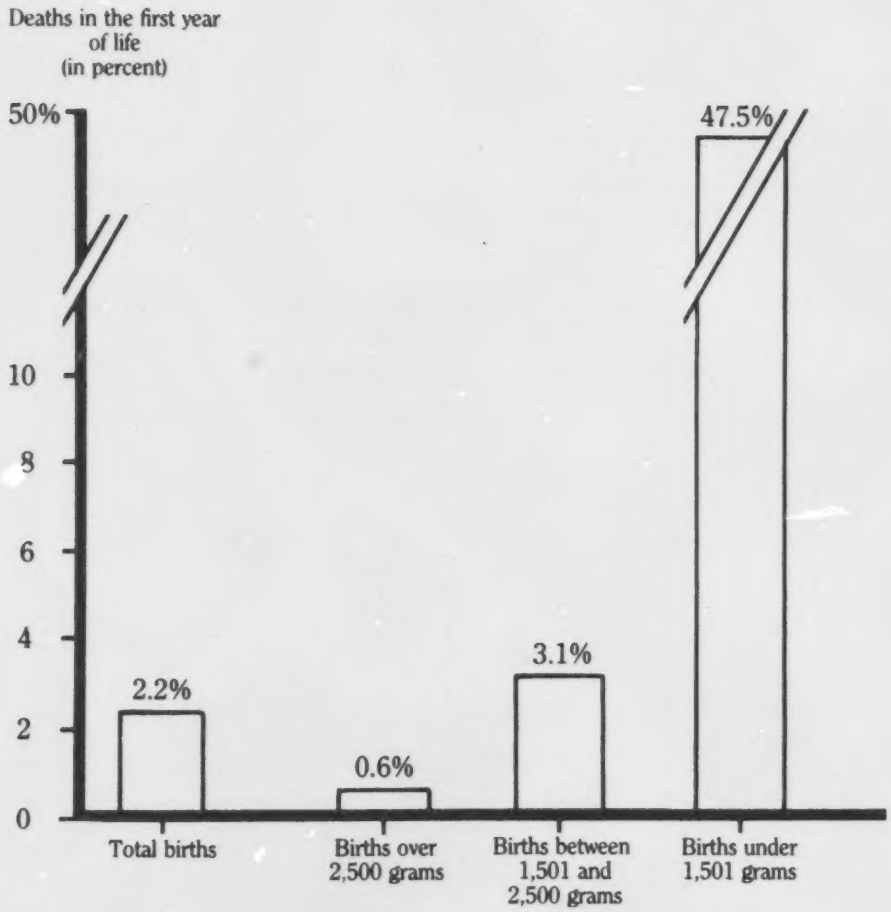
The infant mortality rate in the District of Columbia is among the highest in the nation. The rate stems from the high percentage of seriously underweight infants born here.

In the case of newborns, bigger is almost always better. An infant of normal birth weight (over five and a half pounds) has less than a one percent chance of dying in its first year of life. An infant of low birth weight (between three and a third pounds and five and a half pounds) has slightly more than a three percent chance of dying in its first year of life. And an infant of very low birth weight (under three and a third pounds) has nearly a fifty percent chance of dying in its first year of life, as Chart 1 shows (overleaf).

Infants of low and very low birth weight make up a higher percentage of total births in the District than they do in most other parts of the country. This higher percentage accounts for much of the District of Columbia's high infant mortality rate because these seriously underweight infants are at much

CHART 1

Infant deaths by birth weight Infants born in 1979 to District of Columbia residents



Source: Table A-1

higher risk of dying. Chart 2 (overleaf) compares the birth weights of infants born in the District of Columbia to those of infants born in New York City, North Carolina, and Michigan.

Preventive and Medical Approaches

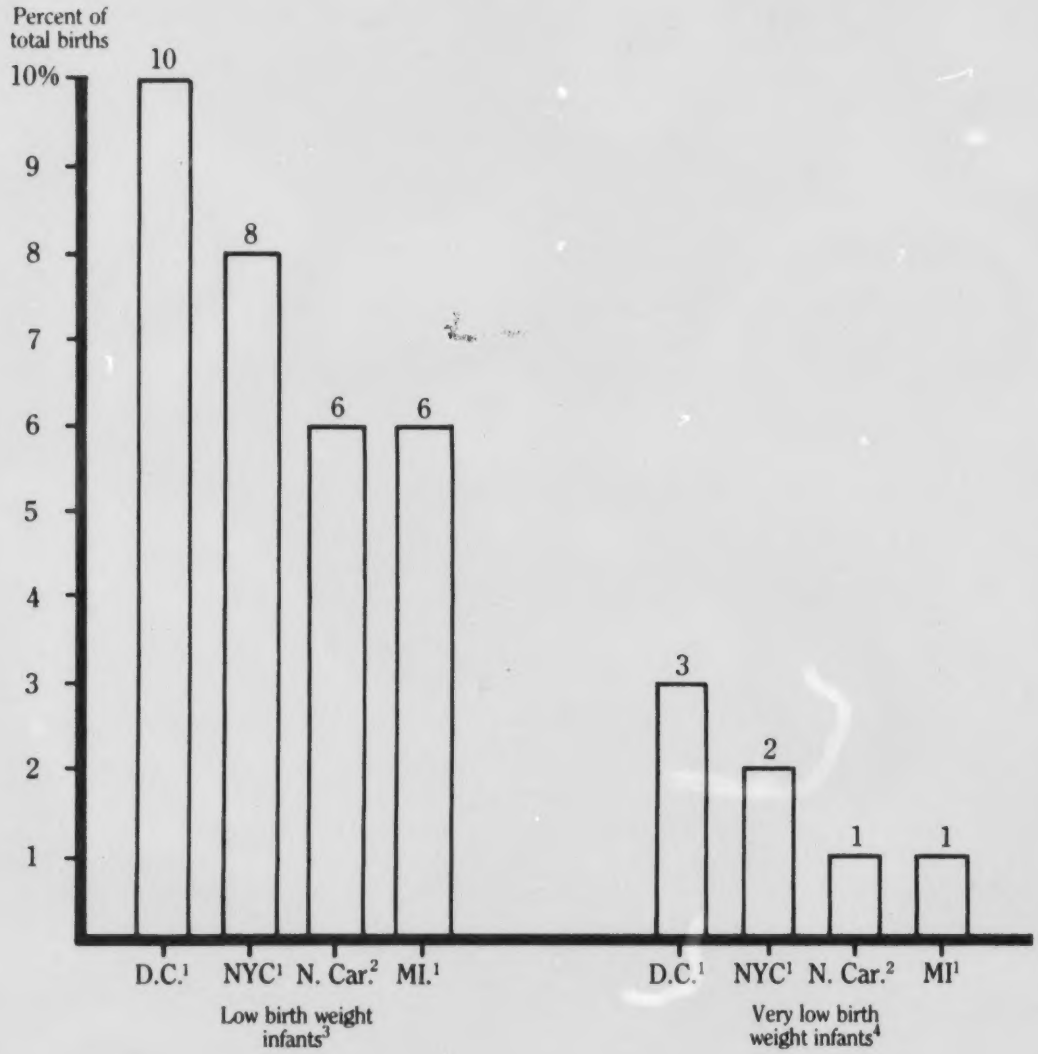
There are two ways to try to improve infant mortality rates. One -- the preventive approach -- is to try to decrease the numbers of underweight babies born. The other -- the medical treatment approach -- is to try to improve the chances of survival of infants who are seriously underweight at birth. The District's recent efforts to lower its infant mortality rates have centered on the medical treatment approach.

Over time, much of the cost of medical treatment for premature infants -- as much as $100,000 for one seriously underweight baby -- is paid for by Medicaid. In the District of Columbia, Medicaid funds come half from Federal funds and half from District funds. The long-term costs of maintaining seriously impaired low birth weight survivors -- as much as $500,000 for a single survivor -- also fall on the public purse. One expert estimates the District incurs a total of $20,000,000 in lifetime care costs for low birth weight survivors each year.

Would it not be wise to spend a fraction of this sum on increasing the number of full-size, healthy infants born? The availability of good quality medical treatment will always be necessary to care for those seriously underweight infants who

CHART 2

Comparison of infants of low birth weight (LBW) and very low birth weight (VLBW) born to residents of the District of Columbia, New York City, North Carolina and Michigan (1979–1980)



1. Infants born in 1979
2. Infants born in 1980
3. Weighing between 1,501 and 2,500 grams at birth
4. Weighing under 1,501 grams at birth

Source: Table A-15

are born. But a program to reduce prematurity offers promise of helping save infant lives, reducing infant handicaps and illnesses, and saving significant amounts of public funds.

At least three key elements serve to discourage the adoption of preventive programs. These are: the intangible nature of preventive programs as compared to the tangible nature of medical treatment; the training physicians are given, which emphasizes medical treatment; and the lack of an established system to foster and coordinate preventive efforts.

Potential Benefits of the Preventive Approach

Preventive programs that address key maternal factors associated with seriously underweight infants have been used elsewhere, and with good results. A cluster of factors, including early and continuous prenatal care, adequate nutrition, and the absence of smoking, alcohol, and drug abuse, appears to be associated with higher birth weights. Although opinions vary as to the extent, experts agree the District's infant mortality rate could certainly be lowered if more birthweights were at normal levels.

Most underweight infants born to District residents appear to be born to poor black women. While prenatal care and nutritional supplementation services are available in the city, for a variety of understandable reasons some poor black women do not take advantage of these services. They also do not get adequate warning that some of their personal health habits --

such as smoking and the use of alcohol -- are of potential harm to their unborn children.

Call for a Policy of Preventing Prematurity

This paper recommends an aggressive prevention outreach program, targeted to specific geographic areas of the District whose residents have a high incidence of prematurity. The program would be staffed mainly by community residents led by a qualified professional to identify high-risk mothers, bring them into the system, and encourage them to follow preventive practices.

A common argument against the preventive approach is that it can be extremely costly, but if one looks specifically at the District, it is not difficult to imagine a remarkably low-cost outreach and assistance program. Such a program could be limited -- through geographic, economic, and medical criteria -- to relatively small numbers of women. Given the high cost of medical treatment, a program to prevent prematurity that met with even modest success would more than repay the investment -- and would save lives.

For such a policy to realize its potential, all segments of the community will need to cooperate with one another in a coordinated fashion. The District needs:

- o a commitment to the concept of preventing prematurity;
- o a long-range plan that brings together the public and

private sectors;

- a single, full-time, senior official, who has the full confidence of the Mayor and the Commissioner of Public Health, to lead and coordinate a city-wide preventive program; and
- a pilot outreach program along the lines described in this report, funded for three years (if it is successful it will be highly cost-effective and should be continued indefinitely).

The District cannot do this alone. It will need the wholehearted cooperation of medical professionals, of church, civic, and other citizens' groups, of teachers, of voluntary agencies, of the media, and of the public at large. And together all of us will need to seek and win the wholehearted cooperation of high-risk mothers.

While it is important not to make grandiose claims for a preventive approach, prevention can be expected to yield some success. Whenever a small success saves a life, it becomes large indeed.

The Prevention of Prematurity

The Problem of Infant Mortality in the District of Columbia

In the District of Columbia, the infant mortality rate is among the highest in the nation. Brought to widespread public attention during the 1978 and 1982 mayoralty campaigns, the District's infant mortality rate (deaths of children under one year of age per thousand live births) has been the focus of newspaper articles, Congressional hearings, a Blue Ribbon Committee, conferences, a Robert Wood Johnson Foundation study, and much public concern. The rate's reduction is one of the six priorities of the District's State Health Planning and Development Agency for 1982-1983.

Table 1 shows births, infant deaths, and infant mortality rates for the District over the last 12 years. The total number of infant deaths was halved during this period, falling from 432 in 1970 to 211 in 1981. However, the infant mortality rate during these years declined by only 22 percent, reflecting the smaller total number of births in 1981 than in 1970.

Much of the public attention given to the District of Columbia's infant mortality rate stems from the fact that it is not only higher than that of any state in the United States but also higher than that of nearly all of the world's developed countries. Although both the District and the U.S. averages have been declining over the last decade, the gap between the District's infant mortality rate and the lower rate for the United States as a whole has steadily increased. During 1966

Table 1
Births, infant deaths, and infant mortality rates[1]
for residents of the District of Columbia
(1970-1981)

Year	Total births	Infant deaths	Infant mortality rate[1]
1970	14,960	432	28.9
1971	13,914	396	28.5
1972	11,886	323	27.2
1973	10,837	276	25.5
1974	10,037	277	27.6
1975	9,746	279	28.6
1976	9,635	240	24.9
1977	9,885	270	27.3
1978	9,372	242	25.8
1979	9,403	207	22.0
1980	9,257	228	24.6
1981	9,332	211	22.6

[1]Deaths in the first year of life per 1,000 live births.

Source: Research and Statistics Division, Office of Policy and Planning, Department of Human Services, District of Columbia.

to 1968, the District's average was about 30 percent higher than the national average. During 1976 to 1978, the District's average was 85 percent higher than the national average (see Table 2).

Table 2
Comparison of infant mortality rates in the District of Columbia and in the United States

	Average annual rate[1]		
	1966-1968	1971-1973	1976-1978
District of Columbia	29.3	27.1	26.6
United States	22.7	18.5	14.4

[1]Deaths in the first year of life per 1,000 live births

Source: U.S. Department of Health and Human Services: Health, United States, 1981 [p.113]. DHHS No. (PHS) 82-1232. Public Health Service. Washington. U.S. Government Printing Office. December, 1981.

Dangers of Low Weight at Birth

A baby is much more likely to die in its first year of life -- and thus add to the infant mortality statistics -- if it is seriously underweight when born. Babies with a normal birth weight (5-1/2 pounds or more) have an average infant mortality rate of about five: that is, out of every thousand babies of normal weight who are born, about five will die before their first birthday. Babies weighing under 5-1/2 pounds at birth are less likely to survive. As a recent U.S. Surgeon General's

Report (Office of the Assistant Secretary for Health, 1979) states, "Low birth weight is the greatest single hazard for infants, increasing vulnerability to developmental problems -- and to deaths....Of all infant deaths, two thirds occur in those weighing less than 5-1/2 pounds....Infants below this weight are more than 20 times as likely to die within the first year [p.24]."

Medical personnel studying the problem of infant mortality have divided newborns into three general categories:

- Infants of normal birth weight -- 5-1/2 pounds (2,501 grams) or more;
- Infants of low birth weight -- less than 5-1/2 pounds (2,501 grams); and
- Infants of very low birth weight -- less than 3-1/3 pounds (1,501 grams).[1]

For newborns, bigger is almost always better. In the District of Columbia, for example, the total infant mortality

[1]Infants below normal birth weight vary both gestationally and developmentally. Some are born prematurely before completing their allotted nine months' gestation in their mother's womb. Of that group, some are the appropriate size for the time spent in the womb, while others are underdeveloped (small for their gestational age). Still others are born after their full nine months' gestation, but have birth weights that are in the same range as truly premature infants. Epidemiological studies have shown that birth weight by itself is adequate for analyzing data from vital statistics (c.f. Madans et al., 1981) and that practice will be followed here.

rate for children born in 1979 was 21.6. But the mortality rate was 475.1 -- nearly one death for every two births -- for infants weighing 1,500 grams or less. The rate dropped sharply to 30.5 for infants between 1,501 and 2,500 grams, and was a relatively insignificant 6.3 for infants weighing 2,501 grams or more (see Appendix Table A-1).

Variations in Infant Mortality Associated with Race

Anyone who looks at the figures closely soon sees that this country's infant mortality rates vary dramatically by race. Since 1960, the white infant mortality rate in the United States has consistently been almost half the infant mortality rate for blacks. The rates for both whites and blacks dropped by nearly 50 percent between 1960 and 1978, but the gap between the two has remained unchanged. As of 1978 -- the latest year for which figures are available -- the national infant mortality rate averaged 13.8. In that same year the national black rate was 23.1, while the white rate was 12.0 (see Appendix Table A-2).

This difference between whites and blacks is nearly the same in the District of Columbia. In 1981, the District's black infant mortality rate was 25.5, while its white rate was 14.1 (see Appendix Table A-3). Therefore, since births of

white infants in D.C. have averaged less than 14 percent of the city's total births over the past dozen years, the District's high infant mortality rate reflects its unusually high percentage of black births. By contrast, the United States averages over 80 percent white births -- more than five times the District's average.

When we compare the infant mortality rate of Washington, D.C., with that of 15 other U.S. cities by race, we see that D.C.'s white infant mortality rate is lower than the others' white rates in nearly half the cases. Although the District's infant mortality rate for nonwhites is higher than that of any of the other cities, in at least one case the difference is statistically insignificant (see Appendix Table A-4).

These non-white comparisons are somewhat misleading, however, as the category "other races" includes races other than black.[2] High rates of infant mortality in the U.S. as a

[2]In the District of Columbia, through 1981 virtually all nonwhite births to city residents have been black. Some D.C. statistics are released as "non-white" and "white," and some as "black" and "white." As the Asian population of the District is currently increasing, these distinctions may take on greater significance in the near future.

whole are specifically associated with blacks because blacks in this country have a disproportionate number of babies of low and very low birth weight compared to whites, as Table 3 shows. Over the period 1970 to 1978, very low birth weight (VLBW) babies -- the extremely high-risk group -- accounted for about 1.2 percent of all U.S. births, but in births to U.S. blacks the VLBW percentage was twice as high. Whites' VLBW percentage was about one-third of the black rate, 0.9 as compared with 2.4. If, as we have seen, a VLBW baby born in the District is more than 85 times as likely to die as is a baby of normal weight, then the more VLBW babies born as a percentage of the total, the higher the infant mortality rate. Thus, the high infant mortality rate associated with blacks in this country arises chiefly from the greater percentage of blacks born at very low birth weights (Budetti et al., 1981).

Table 3
Live births in the United States, according to race and birth weight
(averages for 1970-1978)

	Percentage of Total Births		
	Total	Black	White
2,500 grams or less (low birth weight)	7.5	13.2	6.3
1,500 grams or less (very low birth weight)	1.2	2.4	.9

Fuller figures are given in Appendix Table A-5.

Similar differences in the incidence of very low birth weight hold true for blacks and whites in the District of Columbia. During the period 1970-1978, the District's VLBW black births averaged 2.7 percent, 14 percent higher than the national VLBW black average (Appendix Table A-5). This difference is especially significant when nearly one out of every two babies making up that difference is likely to die. But it is the massive VLBW difference between D.C. blacks and U.S. whites -- a difference of three times -- that illuminates the origin of the District's high infant mortality rate.

Recent Efforts to Lower the District's Infant Mortality Rate

There are two ways to try to improve infant mortality rates. One -- the preventive approach -- is to try to decrease the number of babies born at low and very low birth weights. The more babies who weigh over 5-1/2 pounds, the fewer babies who will die. (Successful efforts to reduce the incidence of low birth weight elsewhere are described later in this paper.) The other -- the medical treatment approach -- is to try to improve the chances of survival of infants who are seriously underweight at birth.

When the District's high infant mortality rate became a public issue, efforts to reduce it centered around the medical treatment approach (Boone, 1982; Newland, 1981). The impetus for this focus stemmed from two general facts. First, the

effects of improved medical treatment are soon shown in the statistics, while any positive effects of a preventive program may not be shown in the infant mortality rates for as long as three years. Second, many people felt that the District's medical treatment of newborns was seriously deficient, compared with that of other cities. These observers noted that the District's nonwhite infant mortality rate remained virtually constant over the period 1970-1978, while the rate for U.S. blacks dropped by nearly 30 percent. Much of that U.S. drop stemmed from improvements realized in the first 28 days of newborns' lives (the neonatal period), indicating to many that the problem could be traced to inadequate hospital treatment in the District. In that nine-year period, the District's nonwhite neonatal mortality rate declined by about 4 percent, while the national black rate declined by 32 percent.

It is interesting to note that, over those same nine years, the national mortality rate for black infants aged 29 days to just under one year (the postneonatal period) declined by 23 percent. The postneonatal mortality rate for D.C. nonwhites actually rose during that period by 16 percent (see Appendix Table A-6). Variations in postneonatal mortality hint at difficulties that are not medical ones, but these variations do not seem to have had much effect on the city's approach to the problem.

A study of 1977-1978 births by the Perinatal Mortality Committee of the National Capital Medical Foundation (the District of Columbia's Professional Standards Review Organization) found evidence of what it viewed as inadequate neonatal medical practices in dealing with small premature infants in several hospitals (Perinatal Mortality Committee, 1979). Another study by an expert from the National Center for Disease Control (Oakley, 1979) stated that improved intensive care techniques and technology would substantially improve the District's infant mortality rate. A third study prepared by experts at the National Center for Health Statistics of the District's 1970-1978 data (Madans et al., 1981) also suggested that improved infant intensive care and treatment could improve the District's neonatal mortality rate.[3]

[3]The analysis by Madans et al. of differences among D.C. hospitals showed that there were variations in adjusted neonatal mortality trends over the period 1970-1978 and stated that "these variations are responsible, to a large extent, for the lack of decline in D.C.'s neonatal mortality [p. 16]." However, the authors go on to point out that "the high adjusted neonatal mortality in some District hospitals may be due to the very high level of risk among the patient population...the population[s] served by these hospitals are among the poorest in the nation and generally have the lowest levels of prenatal and other preventive health care. To the extent that these factors have a direct effect on survival over and above the effect that is mediated through birth weight, the hospitals serving these populations are at an added disadvantage [pp.16-17]." For a discussion of such factors in more detail and their effect on survival, see Boone, 1982.

In consequence, much time, effort, and money have been devoted to improving medical treatment of low birth weight (LBW) and VLBW infants born in the District. And, in an analysis apparently not widely known to the public, the National Capital Medical Foundation found that by 1980 significant improvements had been made. The Foundation's Perinatal Mortality Committee audited the mortality of all infants with a birth weight of 1,000 to 1,500 grams who were born in 1980 within nine District hospitals. The study (Perinatal Mortality Committee, 1981), which involved 181 babies delivered by 173 mothers (both D.C. and non-D.C. residents), showed that mortality decreased from 23.4 percent to 19.9 percent. "Striking declines occurred in two hospitals which contributed disproportionately to the mortality in 1977...in the first audit mortality ranged from 14 percent to 33 percent [pp.6-7]."[4] The report found that the neonatal mortality in 1980 for the very low birth weight group audited was comparable to that of several other regions two to three years earlier (then the most recent comparable data). The D.C.

neonatal mortality rate for the 1,000 - 1,500 gram infants was 18.2 percent, as compared to 18 percent for 1,845 similiar

[4]Note that the report is referring to mortality not in terms of infant mortality rates but in actual percentages. Note also that the group under study was of very low birth weight -- a very high-risk group.

infants in New England in the late 1970s, 17 percent in Vermont and New Hampshire in 1976-1979, 14 percent in Denver, 17 percent in Boston, 19 percent in Cleveland, and 17 percent in Florida (seven centers). If the District's medical treatment of VLBW infants were seriously deficient, then its VLBW neonatal mortality rate would have been higher than that in these other areas. Instead, the rates were quite similar.

Disadvantages of the Medical Treatment Approach

When an infant is born at very low weight, the time for prevention has passed. Only medical treatment can be used to try to save the infant's life. But focusing scarce resources almost exclusively on medical treatment of VLBW infants at the expense of preventive programs to reduce prematurity may adversely affect infant survival and infant health, may result in costly private and public expense, and may increase the incidence of infant abuse and neglect. Let us examine these disadvantages one by one.

Saving lives is the first aim of medicine. Yet, if an infant has less than a one-percent chance of dying if its weight is over 2,500 grams, but a nearly fifty-percent chance of dying if its weight is under 1,500 grams, then obviously if we can manage to have an infant born at a normal birth weight

rather than at a very low birth weight we have a much better chance of saving its life.

The risk experienced by infants of very low birth weight is well documented in the medical literature. To take just one example, Hack et al. (1979) reported a study of 291 very-low-birth-weight infants admitted to a neonatal intensive care unit in Cleveland during 1975 and 1976 and followed to a mean of two years' conceptual age. Of the 90 infants weighing between 501 and 1,000 grams, 54 died, 4 were lost to follow-up, 7 were seriously impaired, and 25 were normal. Of the 201 weighing between 1,001 and 1,500 grams, 48 died, 25 were lost to follow-up, 20 were seriously impaired, and 108 were normal. (See Appendix Table A-7 for national comparisons of infant mortality and morbidity between LBW and normal-weight infants.)

A second disadvantage of the medical treatment approach is found in the tragic lives of some of the survivors of such treatment. Here, for example, is the opinion of William H. Kirkley, M.D., given in his presidential address at the Forty-Second Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists. Of VLBW survivors born with neural tube defects, a particularly disabling physical handicap, Kirkley (1980) says, "Some of us consider their presence not as a tribute to a medical achievement but as an accusation against misuse of medical power [p. 874]." Later in

his address, aptly titled "Fetal Survival -- What Price," he says, "I believe this aggressive approach to neural tube defects shows what horrors well-intended medical management may produce."

The issue of morbidity (serious handicap) among VLBW survivors is troubling. Koops and Harman (1980) surveyed studies of the long-term outcome in newborns with birth weights under 1,500 grams. They found that before neonatal intensive care, most low-birth-weight survivors were free of gross handicaps at 15-18 years of age. The incidence of handicaps among these survivors did not differ significantly from that of children with higher birth weights. Then, in the early years of intensive care of the newborn, as more lives were saved the incidence of serious handicaps rose "from about 20 percent to 44-68 percent [p. 3]."

However, as medical treatment of small newborns has continued to improve, so have their outcomes, although experts disagree to what extent. Kirkley (1980) estimated from a survey of the American literature that 15 percent of all babies weighing 2,000 grams or less have physical and/or mental handicaps. Koops (1980) stated that babies with birth weights under 1,500 grams show "a current incidence of 20 percent significant sensory, neurologic, or mental sequelae in survivors [p. 23]." Budetti and his colleagues (1981)

estimated (on the basis of reports from the literature) that less than 14 percent of surviving infants with birth weights under 1,500 grams and about 16 percent of surviving infants with birth weights under 1,000 grams suffered serious handicaps, and added "Present data indicate that on the order of 10 to 12 percent of infants weighing under 1,500g will suffer intellectual or neurologic problems that do not constitute major handicaps [p. 37]." They advised that "...great caution is needed in interpreting data on minor problems because there are no reliable standards for the incidence of behavior, language, and mild neurologic problems in the general population of children [p. 37]."

In a May 26, 1982 letter to me on this subject, C. Arden Miller, Professor and Chairman of the Department of Maternal and Child Health at The University of North Carolina, wrote:

> Twenty or thirty percent of the graduates of intensive care units may experience subsequent learning disability or other handicap. I believe this is a conservative estimate, considering that about fifteen percent of unselected populations of school children are found to have such handicaps. Most of the current studies report only very short-term follow-up and only for the most extreme forms of handicap that can be identified in the first year or two of life. Most studies document

> that the proportion of [unselected populations of] children who require special educational, medical, or emotional support services increases dramatically after age two and even more dramatically at age ten.

And Budetti et al. (1981) observed, "...it appears that the incidence of serious problems in survivors of neonatal intensive care is probably declining [from the early days of such care]...however..., at the same time the incidence of serious problems is decreasing, the absolute number of severely handicapped individuals may be increasing [p. 5]." This is because while handicapped VLBW survivors as a percentage of all VLBW survivors appears to be declining, greater total numbers of VLBW babies are surviving than used to be the case.

Budetti et al. (1981) stated that in addition to handicaps, "it is clear that extremely low birthweight survivors carry a very high burden of illness [p.37]." Even those survivors who are apparently free of handicaps suffer serious illnesses. According to a study by Shapiro et al. (1980), "about one third of those weighing 1500 grams or less at birth with no delay/congenital anomaly experienced illness that resulted in hospitalization or extended care out of hospital [p. 366]."

A fourth negative consequence of the medical treatment approach must be mentioned. This is the high incidence of abuse and neglect suffered by very low birth weight survivors, an outcome often reported in the medical literature. Hunter et al. (1978) reported a study of 255 infants in North Carolina which showed an eightfold increase in risk of reported and confirmed abuse and neglect among premature and ill newborns during the first year of life as compared to the statewide average for all infants. Koops and Harman (1980) said that "...increased incidence of child abuse and family disruption...have been found on long-term follow-up [of VLBW survivors] [p.23]." Maden and Wrench (1977) summarized 14 studies conducted between 1966 and 1977 which showed that between 12 and 60 percent of abused children were LBW babies, compared with only 5.6 to 20 percent in control populations of higher weight. Of the reported variations the authors judged to be statistically significant, low-birth-weight children suffered between two and four times more abuse and neglect than did their control populations.

Maden and Wrench cited speculation that "...low birth weights...may trigger parental disappointment over the newborn [p.213]." Klein and Stern (1971) said "...our data suggest that multiple factors may be operating to select the low birth weight infant for battering, i.e., preexisting mental

retardation, maternal deprivation, and isolation from the mother in the newborn period [p. 17]." And Lynch (1976), in a well-controlled study comparing abused children with their unharmed siblings, found six factors to be "highly significantly overrepresented" in the biographies of the abused children: "abnormal pregnancy; abnormal labor or delivery; neonatal [newborn] separation; other separations in the first six months; illness in the first year of life and illness in the mother in the child's first year of life [p.46]." Many of these factors are present in the biographies of low birth weight infants.

The financial toll is also extreme. Kirkley (1980) estimated hospital costs for "normal" infants who weighed 1,000 grams or less at birth -- not including any charges made by physicians -- to be $140,800 in 1980 dollars per child. C. Arden Miller of The University of North Carolina in a May 18, 1982 letter to me stated, "it is now estimated to cost about a hundred thousand dollars to graduate a low birth weight baby from [an intensive care unit]."

These costs are, of course, for immediate medical treatment only. They do not include the long-term financial costs incurred by society for the maintenance of the low birth weight child who has severe physical and/or mental handicaps.

This can total $500,000 or more over the lifetime of a severely handicapped survivor.[5]

Payment of Medical Treatment Costs From Public Funds

Over time, much of the cost of medical treatment for premature infants is paid for not by private dollars but by public dollars. This is true even though many of the decisions covering the nature and extent of the medical treatment system are made by the non-governmental sector -- that is, by private hospitals and privately employed medical professionals.

The reason why this is so is that medical treatment expenses of $100,000 for a newborn are far beyond the financial reach of all but a tiny handful of the population. Further, as we shall soon see, low and very low birth weights are often associated with poverty, so that families in these cases are typically unable to bear any of the costs of medical treatment. Thus the expense falls to Medicaid. Medicaid funds in turn come half from Federal funds and half from state funds. In the case of the District, the city must pay the half of Medicaid costs normally alloted to the state, as the city has no state

[5]Readers familiar with the work of the social theorist John McKnight of Northwestern University (McKnight, 1978) will quickly recognize that nearly all of this large amount of money goes to professionals who are members of the middle class and little if any goes to the baby or parents directly involved.

to pay the expense. All Medicaid dollars, whether from the District or from the Federal Government, arise from taxes paid by the general public.

The long-term costs of maintaining seriously impaired VLBW surviors also fall on the public purse. A badly handicapped child born to a family in poverty requires expensive support systems which that family is totally unable to pay. Indeed, few families in the nation can muster the $500,000 in support funds an individual handicapped survivor may require over his or her lifetime. One expert estimates the District incurs a total of $20,000,000 in lifetime costs for VLBW survivors each year.

Although these facts are well known to economists, they appear to be surprisingly little known to many medical professionals and government officials. Two people who reviewed this paper in draft told me firmly that medical treatment relies primarily on private funds. Yet, as we have just seen, this statement is not accurate.

A brief review of the facts demonstrates that the absence of an effective program to prevent prematurity is by default a decision to allocate public dollars to medical treatment. This is because once a VLBW infant is born, it must be cared for. The more VLBW infants born, the more medical treatment necessary. The fewer VLBW infants born, the less medical treatment necessary.

We will always need to have skilled medical treatment available to deal with VLBW infants. No prevention program could hope to eliminate all VLBW births. But, since very low birth weights are associated with prematurity, a program to prevent prematurity would offer promise of

- o helping save infant lives;
- o lowering the incidence of serious handicaps;
- o reducing serious illnesses in the newborn;
- o reducing child abuse and neglect; and
- o saving significant amounts of public funds.

Barriers to the Preventive Approach

At least three elements serve to discourage the adoption of programs to reduce prematurity through prevention. These are: the intangible nature of preventive programs as compared to the tangible nature of medical treatment; the training physicians are given; and the lack of an established system to foster and coordinate preventive efforts.

Most people prefer the tangible to the intangible, the concrete to the abstract, the here-and-now present to the amorphous future. Medical treatment of infants of very low weight is highly tangible, concrete, and firmly rooted in the present. Psychic rewards to practitioners are great. A medical professional who saves the life of an underweight

newborn can see a living proof of that achievement. By contrast, preventive approaches are intangible, abstract, and oriented toward the future. Psychic rewards to people working in prevention are much less dramatic. As LaSalle D. Leffall, Jr., a former president of the American Cancer Society, has observed: there are no gold medals for prevention. Prevention's slow, undramatic nature makes it less emotionally appealing than medical treatment.

Because the issue of infant mortality involves serious illness and death, we have looked to physicians for leadership in attempting to lower the rates. And most physicians intellectually and spiritually support preventive approaches. However, the training physicians receive quite understandably emphasizes medical treatment. Consequently, although they often strongly support preventive approaches in theory, most physicians direct their own personal energies and leadership as they were trained to do:

- "Health people are more medically oriented than health oriented. The physician has a tendency to be medical. But he is taught to relieve suffering and pain." -- Dr. Arthur Hoyte, Commissioner of Public Health, District of Columbia (1982 personal conversation with me)

- "As a physician I focus on acute treatment." -- A senior official of the Mayor's Advisory Commission on Maternal and Child Health (at a conference on infant mortality held in 1982 at Howard University Hospital, Washington, D.C.)

- "You must understand as far as prevention goes I am at the other end of the food chain." -- Dr. Gordon Avery, Chairman of the Department of Neonatology, Children's Hospital, Washington, D.C., a well-known supporter of preventive approaches (1982 personal conversation with me)

An extreme example of physicians focusing on medical treatment is cited in Newland (1981): "In Cali, Colombia, a modern hospital boasted of a low death rate among low-birth-weight babies equal to that in North America ... but 70 percent of the babies died within three weeks of leaving the hospital due to inadequate water, sanitation, nutrition, and immunization programs [p. 43]." While the Colombia example certainly overstates the relationship between medical treatment and prevention with regard to infant mortality in this country, there is no question that in many American communities the medical treatment approach to the problem dominates. As Dr. C. Arden Miller of The University of North Carolina wrote in a May 18, 1982 letter to me:

> The nation seems to be in the middle of a medical arms race in which competing medical institutions attempt to acquire the most elaborate and sophisticated facilities and staff. This competition is especially keen on maternity and newborn services. There seems to be little doubt that survival rates among extremely low birth

> weight babies have improved. There is also little doubt that only a few such babies need to survive in order to improve aggregate statistics appreciably...Although no one can reasonably argue against providing the best services available for the care of low birth weight babies, prudence suggests that many communities need vastly more strenuous efforts to reduce the rate of low birth weight.

Strenuous efforts of the kind Dr. Miller advocates require strenuous leadership. But if physicians' energies are focused on what they are trained to do -- render the best medical treatment they can -- then where will the leadership be found? The leadership vacuum may be epitomized in the statement heard in so many aspects of life: "Sorry that's not my department."

Speaking of the national picture in regard to the absence of leadership in prevention, the Comptroller General of the United States reported (1980), "Systematic approaches for seeing that prenatal and well baby care needs are identified and met are generally lacking at the state and local level. Links among planners, service providers, or funding agencies are often lacking, as is cooperation between public health departments and the private medical community [p. 106]." In another part of the same report [p. 107] the Director of

Obstetrics at the University of Mississippi Medical Center was quoted as saying:

> The most significant barriers to improving pregnancy outcome are the lack of a "system" for addressing the problem and relatively little coordination and cooperation -- sometimes competition -- between the public health sector and the private medical community...almost all the effort specifically directed at improving pregnancy outcome has been through the public sector with little input or collaboration with the private sector.

Speaking of the specific medical treatment versus prevention situation in the District of Columbia, Dr. Stanford A. Roman, the former Medical Director of D.C. General Hospital, testified to the U.S. Congress (Roman and Boone, 1980) that:

> It must be recognized that no health program committed to reducing infant mortality rates can separate hospital care at delivery from the out-of-hospital prenatal care among high risk mothers...If the needs of the patient can be addressed within a single institution or the capabilities of that institution are fairly broad, the patient may receive the best care possible.

> If, however, the organizational or institutional lines are crossed there is a high probability that the patient's care will become fragmented among a maze of non-communicating medical professionals [p. 3].

But the "maze of non-communicating medical professionals" is but a sub-set of a much bigger maze: the aggregation of public and private services known misleadingly as "the system." The lack of leadership for preventive programs can be seen in the District as well as in other parts of the country. A social worker employed by a private voluntary agency working in very-low-birth-weight prevention reported in early 1982: "The fragmentation of services is incredible in Wards 7 and 8 [the poorest wards in the District]. There seems to be no coordination or full knowledge of available community resources by any one program in the area." And a senior District official working in maternal and child health told me in 1982 that no mechanism currently exists in the District to bring agencies together. "The big need is some kind of coordinating facility," she said. "We need a catalyst."

Before looking in more detail at current preventive efforts in general and their possible benefits to the District of Columbia in particular, let us look at specific maternal factors associated with low-birth-weight babies.

Maternal Factors Associated with Low-Birth-Weight Infants

In a national report on disease prevention, the U.S. Surgeon General stated (Office of the Assistant Secretary for Health, 1979) that key maternal factors associated with low-birth-weight infants include: "lack of prenatal care, poor nutrition, smoking, alcohol and drug abuse, age (especially youth of the mother), social and economic background, and marital status [p. 24]."

Perhaps the most widely known of these factors is the importance of prenatal care. A special report on child health prepared by a panel convened by the U.S. Department of Human Services (the Select Panel for the Promotion of Child Health, 1981) observed:

> The effectiveness of prenatal care in reducing low birth weight -- the most important predictor of illness or death in early infancy and of the need for neonatal intensive care -- has been so well demonstrated...that even the most skeptical...would agree that this form of preventive care is one of our most valuable in promoting child health. [p. 194]."

Quick et al. (1981), after adjusting for sociodemographic factors, found "...a strong relationship between prenatal care and pregnancy outcome." Although Quick was careful to point

out that it is not necessarily a causal relationship, his study reported that "With maternal risk held constant, low birth weight, neonatal mortality, and infant mortality were 1.5 to 5 times greater with late, less frequent prenatal care than with early, frequent care [p. 381]." He and his colleagues add, "The magnitude of the impact of prenatal care is greatest for women at medical-obstetric risk [p. 388]." While this finding may not seem surprising, it is useful to note that middle- and upper-income women at medical-obstetric risk tend to seek early prenatal care, but low-income women at similar risk do not.

Prenatal care is seen by several observers as being particularly important for blacks since blacks have a high incidence of low-birth-weight babies. In an article on the recent national decline in infant mortality (National Center for Health Statistics, 1980), Kleinman and Kessel commented that the entire reduction in neonatal mortality for other-than-white infants between 1960 and 1977 resulted from improved mortality rates for specific birth weights. The 1977 other-than-white birth weight distribution was basically unchanged from the 1960 distribution. Gortmaker (1979) said:

> Among black women, differences in prenatal care are associated with substantial differences in the risk of a low birth weight infant. Furthermore, black women with pregnancy conditions who receive inadequate prenatal care

> experience particularly great risk. This finding conforms to clinical experience, since there are a variety of maternal diseases identifiable during pregnancy which can increase the risk of subsequent prematurity and low birth weight [p. 656].

The risk associated with late or no prenatal care can be clearly seen in District of Columbia data. For District residents of all races born in 1979, the infant mortality rate for babies whose mothers received "adequate" prenatal care was 11.7. The rate increased by more than fourfold for babies whose mothers received no prenatal care (see Appendix Table A-8). And for the 181 VLBW babies studied by the Perinatal Mortality Committee (1981) of the National Capital Medical Foundation, mortality was 42 percent among those for whom there was no record of prenatal care, while for those for whom care began before 20 weeks' gestation mortality was 13 percent, a difference of more than threefold.

Prenatal care is only one component part of an effective prevention program. Poor maternal nutrition is another important factor associated with infants of low birth weight. Hemminki and Starfield (1978) calculated that 57 percent of low birth weight in blacks could be attributed to poor nutrition during pregnancy. Guyer et al. (1982) feel this percentage may be overstated, but feel that severe maternal nutritional

deprivation is clearly related to low birth weight. As we shall see in the next section of this paper, nutritional supplementation appears to have a material effect on birth weight in many cases.

Family planning is also believed to be of real potential significance in reducing the incidence of LBW babies. The Select Panel for the Promotion of Child Health (1981) reported some striking estimates of the potential reduction in the nation's infant mortality rates through family planning: "...the potential direct reduction through family planning services is about 10 percent, with postneonatal more responsive than neonatal. Under optimal assumptions...infant mortality might be further reduced by as much as 30 percent [Vol. III, p. 23]."

Another potentially significant factor in the incidence of LBW is smoking. Guyer et al. (1982) state that "Cessation of smoking among pregnant women and prevention, or reduction in the duration, of pre-pregnancy smoking...have the potential to effect the greatest decrease in the low-birth-weight rate in our society because of the large population of young women who smoke [p.1232]." Guyer and colleagues say it has been estimated that if smoking were eliminated among pregnant women the LBW rate could be diminished by 21 to 39 percent.

The previously cited observations of the U.S. Surgeon General on the significance of marital status in relation to infant mortality rates is borne out in the most recent available District statistics. Among low-birth-weight infants, the 1979 infant mortality rate was 22 percent higher for children born out-of-wedlock than for the children of married women. This has increased from an 11 percent difference between the two groups in 1970. A similar increase can be found in the rates for all children of married mothers compared with those born out-of-wedlock. In 1970, the difference between the two groups' infant mortality rates was 37 percent, while in 1979 it had grown to 84 percent (see Appendix Table A-9). During the same period, children born to out-of-wedlock District mothers have significantly increased as a percentage of all children born. While such births comprised 40 percent of the total in 1970, they made up 58 percent of the total in 1980, a dramatic 42 percent increase in number (Morse, 1981, June). Out of every 100 LBW babies born in 1979 and 1980 combined, 70 were born to unmarried mothers.

Some women are legally unmarried but nonetheless enjoy a relatively stable and long-standing relationship with their child's father. Other women are single emotionally as well as legally. Such women are under particular stress both as expectant and as actual mothers.

Successful Efforts to Reduce the Incidence of Low Birth Weight

Documenting the success of preventive approaches to reducing infant mortality is difficult, but it has been done. The U.S. Surgeon General (Office of the Assistant Secretary for Health, 1979) states:

> Maternity and Infant Care (MIC) Projects...have consistently been associated with declines in low birth weight incidence and infant mortality. In Birmingham, Alabama...after the MIC project began...infant mortality in this area dropped from 25 deaths per 1,000 live births in 1965 to about 14 in 1977....In Denver, Colorado, infant mortality was 28 per 1,000 live births when the MIC project began in 1965; by 1972 it was down to 17 [pp. 86-87].

Identifying the precise factors responsible for such declines is even more difficult. One analysis (Sokol et al., 1980) of a Maternity and Infant Care Project in Cleveland found patients who received its perinatal care experienced 60 percent less perinatal mortality than did a non-MIC control group. The authors comment that "it is unlikely that there were differences in the quality of direct medical care received [by the two groups] [p. 156]." Instead, the authors felt it was more likely that the entire maternal and infant support system --

which included patient education, home vists, nutrition assessment and counseling, social service assistance, and dental care -- played an important role in reducing the perinatal mortality rate.

Cumbey (1981) reports encouraging results from a two-year effort to reduce the number of infants with low birth weights in a health district of South Carolina. The health district had a high rate of LBW births and a high proportion of mothers who had inadequate prenatal care, were of low socioeconomic status, had poor nutrition, and lacked education on caring for newborns. In addition, the health district had few physicians and few institutional care capabilities, lacked appropriate maternal risk identification and referral, and lacked transportation.

In a multifaceted effort, the health district increased perinatal services and personnel. It put two Federal programs that include preventive approaches into public health centers, added family planning services, increased prenatal clinics, nursing services and counseling, examinations by a physician, counseling on social services, and health education. Patients judged to be at high risk were given transportation to the health clinic, the physician's office, and the hospital. In addition, a community education program with an emphasis on nutrition was introduced.

Cumbey reports the following results: "in 1977, infants weighing less than 2,500 grams accounted for 10.7 percent of live births....By 1979, the percentage of low-birth-weight infants had declined to 8.9....There was also a decrease in the number of infants born weighing 1,000 grams or less...accompanied by a decrease in the number of deaths of infants weighing less than 2,500 grams [p. 541]."

A federally funded program that attempts to reduce low birth weight through nutritional supplements for expectant mothers is the WIC (Special Supplemental Food Program for Women, Infants, and Children) Program. An evaluation under the supervision of Yale University's School of Medicine of a WIC program in Waterbury, Connecticut (Carabello et al., 1978) studied 1,791 births to WIC participants and a control group of 2,415 births to non-WIC participants over the period 1975-1977. The infant mortality rate for WIC participants was 8.45, significantly lower than the 22.7 non-WIC rate. A 1978 evaluation of 4,126 births in Massachusetts to WIC mothers and a matched non-WIC control group of equal size (Kotelchuck et al., 1981) showed "a small, but positive association with WIC participation...in all pregnancy outcome measures [p. 8]." Low birth weight was 6.9 percent among WIC participants, as compared with 8.7 percent in the matched controls. WIC participants first received prenatal care earlier than did the

controls and had more prenatal visits than did the controls. Among women participating in WIC for nine months, the birth weight was approximately half a pound greater than in the control group. The positive association between WIC participation and pregnancy outcomes was stronger in the subgroup at higher risk, including blacks and teenagers.

A 1978 study conducted by the Harvard School of Public Health (Kennedy, 1979) compared 897 WIC women to 218 women who did not participate in WIC but had been certified as eligible. The researcher determined that WIC participation was "able to decrease the incidence of LBW in the prenatal population served."

Kennedy also compared the cost of the WIC program and LBW hospital costs for the WIC mothers to what she estimated that the total LBW hospital costs would have been for these same births without WIC. Her analysis yielded a cost-effectiveness ratio of $1 for the WIC approach to $3.1 for the non-WIC approach. Comparing similar costs for a group which had attended the same health clinics but was less at risk and so had not been certified as eligible for WIC yielded a cost-effectiveness ratio of $1 for the WIC approach to $1.9 for the non-WIC approach. (It should be noted that Kennedy's cost analysis was for neonatal hospital care only. The increased costs associated with additional LBW morbidity over time would,

of course, have made the cost-effectiveness ratios significantly more favorable to the WIC approach.)

The Need for an Effort to Prevent Prematurity in the District of Columbia

Many members of the medical profession have observed that increasing the numbers of babies of normal birth weight would improve the District's infant mortality rates. The Perinatal Mortality Committee (1981) of the National Capital Medical Foundation stated flatly that "any measures reducing low birth weight and pre-term delivery will have an important impact on infant mortality [p. 7]." This accords with national opinion on the subject. For example, in a Massachusetts study Guyer et al. (1982) found that "...a public-health program to reduce the proportion of babies of low birth weight...would have a major effect in reducing neonatal mortality rates, independently of any improvements in the neonatal intensive-care system [p. 1230]."

But just what would be the potential benefit to the District if the incidence of low birth weight were reduced? Studies have investigated the causes of the differential between the District's nonwhite infant mortality rate and the U.S. black rate. They show that the city's high rate of low birth weights is responsible for about half the difference.

The National Center for Health Statistics (May 1980), in testimony to the Congress, stated, "statistical adjustments for birth weight patterns show that about half of the differential is due to the larger proportion of low-birth-weight infants born to District residents relative to the Nation as a whole. The rest of the differential can be attributed to poorer infant survival rates in the District. However, the reasons for poorer pregnancy outcome are, at this time, largely unexplained [pp. 5-6]." Madans et al. (1981) analyzed the District's non-white neonatal mortality rate in 1976-78 and concluded that "about two-thirds of the difference in the crude rates was due to a poorer birth weight distribution in the District and about one-third was due to poorer survival [p. 15]."

Some of those studying the District's infant mortality speculate that the pool of resident black mothers giving birth has become increasingly high risk over the past decade. Madans et al. (1981) speculate that many of those District women who are at least risk may have migrated to the suburbs. There is a known, clear correlation between LBW babies and low-income mothers. Demographic analyses show that young, middle-income blacks have been steadily moving from the District to the Washington suburbs, especially Prince George's County in Maryland, over the past several years, while for a variety of reasons low-income blacks have tended to remain in the

District. As evidence for the possibility that the maternal population of the District may have become a higher risk group during the 1970s, Madans et al. pointed out that the hospital with the highest standardized neonatal mortality rates had one third of all non-white births to mothers resident in the District in 1970-1972 but only one sixth of all non-white resident births by 1976-1978. Since the hospital's mortality rates remained high even though its percentage of the total non-white births declined, Madans et al. speculated that the cause of these high rates may have been not inferior medical care but rather a population at much higher risk.

Another theory that also postulates a population at increased medical risk was offered by one of the District's statisticians, Mr. Warren W. Morse, in a personal conversation with me. In the District there are currently about 149 reported abortions for every 100 live births. (The regulations covering abortion reporting are such that Mr. Morse speculated the real totals may be higher by as much as 4 percent or more.) If abortion is more frequently selected by middle-income, lower-risk women, as is usually the case nationally, then births to the remaining population may be at higher risk. In 1973, 48 percent of D.C. pregnancies ended in abortion. In 1980, nearly 60 percent of D.C. pregnancies ended in abortion (Byrnes, 1981).

Whether or not the migration and abortion theories are in fact valid, the District's black mothers undoubtedly have received less prenatal care than did black mothers in the rest of the nation as a whole. One of the hallmarks of "adequate" prenatal care is that it begins early, preferably within the first 15 weeks of pregnancy. Between 1970 and 1978 the percentage of D.C. black mothers giving birth whose prenatal care began in either the third trimester or else not at all ranged from 24 percent in 1970 to 15 percent in 1978. These figures greatly exceeded the comparable figures for blacks throughout the nation during the same years -- by between 44 and 66 percent respectively (see Appendix Table A-10). As we saw earlier, late or no prenatal care is clearly associated with poorer pregnancy outcome. The national rates of black women receiving late or no prenatal care declined by 44 percent between 1970 and 1978, while the District rates declined by 36 percent, thus below the national rate of decline. We should note that during this period only about 7 out of 10 black birth certificates in the District reported prenatal care status while 8 out of 10 white birth certificates in the District reported prenatal care status. Since prenatal care status may be more often reported when it has been given than when it has not, the percentage of black women receiving inadequate or no prenatal care in the District may be even greater than the published figures would suggest.

Another indication of the need for efforts to reduce the District's incidence of very low birth weight can be seen in a comparison of 1979 District of Columbia data with similar data from New York City, North Carolina, and Michigan. All four areas break their data down by race and by birth weight. All have large black populations. All provide what is called "linked" data -- that is, they link every infant's death certificate with its corresponding birth certificate, providing specific infant mortality rates by race and by birth weight.

When the District's 1979 data are compared with the others' data, once again the District comes out with the worst infant mortality rate. Its black infant mortality rate is 24.2, New York's black rate is 19.37, North Carolina's "non-white" rate (which is 92 percent black) is 18.8, and Michigan's "all other" rate (which is 96 percent black) is 22.3 (see Appendix Tables A-1, A-12, A-13, and A-14).

When the District's black infant mortality rates are specifically compared to the black infant mortality rates of the other three areas by birth weight, the District's rates are not significantly inferior. Yet the District's total black infant mortality rate is significantly worse than the others' rates because the percentage of VLBW babies born to blacks was higher in the District than in the other areas. VLBW births made up 3.1 percent of the District's total black births, while they

comprised 2.4 to 2.5 percent of the others' equivalent totals, a difference of 20 percent (see Appendix Tables A-1, A-12, A-13, A-14).

When total births are compared, VLBW infants made up 3 percent of the District's total as compared to 2 percent of New York City's total and just 1 percent of the other two areas' totals (see Appendix Table A-15). Since VLBW infants are at highest risk of death, the District's high VLBW rate inevitably increases its infant mortality rate.

VLBW births appear to be directly related to poverty. As the Comptroller General (1980) observed, "many low-income women... often do not seek care promptly, [waiting] until their pregnancies are advanced [p. 1087]." A senior District official with a strong interest in prevention told me that "Women in poverty don't have health care as a priority. Furthermore, they do not believe pregnancy is an illness."

In most instances, such women are completely unaware that certain of their personal health habits can harm the babies they are carrying. This lack of knowledge is hardly surprising since it is only during the last decade or so that advanced medical technology has made it possible to save the lives of so many tiny newborns. Before that time, such babies were viewed as miscarriages and generally ignored by most of the research community. Now that more VLBW lives are being saved,

researchers are studying the causes of VLBW births more closely, but their findings are quite recent and not yet well known to the public in general or to women at high risk in particular. Yet, until women are warned that certain personal habits are potentially dangerous to their unborn children, they cannot be expected to modify these habits.

A number of other factors actively discourage low-income women from seeking early prenatal care. The Comptroller General (1980) cited long travel distances to clinics, long waiting times, and inconvenient hours. In the specific case of the District of Columbia, while public officials have made strong efforts to improve public clinic services, certain discouraging factors persist. These include difficulties with public transportation, medical staff rotation so that a low-income patient often sees a different physician each time she comes, and the normal confusion and pressures to be expected in public clinics serving large numbers of people. As Miller (1981) and others have observed, the question of cost is also a factor for potential patients. While in fact the public clinics will provide prenatal care for all, regardless of ability to pay, fee schedules are prominently posted and in most (but not all) District clinics all patients without third-party payers (Medicaid or health insurance) are sent bills regardless of income. A senior District health official told

me that she believes this practice discourages return visits by those low-income women who are unable to pay the bills they are sent. She suggested that the fee schedules should clearly state that care will be given regardless of ability to pay. She further suggested that women unable to pay not be billed.

Even though they contribute disproportionately to the District's high infant mortality rates, low-income women at high risk are currently the least likely to encounter and benefit from prevention approaches. Many medical professionals and public officials believe that the financial costs of an aggressive outreach program to identify and serve these high-risk mothers would far outweigh the benefits. Speaking nationally, Budetti (1981) stated that "Because so many of the problems of the newborn are associated with maternal factors that can be detected during pregnancy by routine prenatal care and the use of specialized diagnostic procedures, about two-thirds of infants who will require special care can be identified before birth....Unfortunately, such screening is costly and has high false-positive and false-negative rates...some high-risk women will deliver normal infants, while some low-risk women will produce sick ones [p. 14]." As Miller (1981) pointed out, the Mayor's Blue Ribbon Committee on Infant Mortality in the District of Columbia concluded that "this identification was not sufficiently feasible to consider targeting during the prenatal phase [p. 47]."

This belief is reflected in city policy. Public health nurses have been cut from some hundreds in the early 1970s to under twenty today. Washington's Improved Pregnancy Outcome project -- which originally included 15 people who were to help with outreach services and six public health nurses -- has used up its five-year Federal funds and is not currently scheduled to continue. Although two important federally funded nutritional programs exist in the city -- the one-year-old Women, Infants, and Children (WIC) program and the thirteen-year-old Commodity Surplus Food Program (CSFP) -- they do not include aggressive outreach programs. Nor is counseling pregnant women on health practices a major function of either program[6].

In a major study of the District's infant mortality funded by the Robert Wood Johnson Foundation, Miller (1981) strongly recommended that five outreach workers be attached to the District's public health clinics to initiate community visits as well as respond to referrals. He cited the Mayor's Blue Ribbon Committee's estimate that of those mothers whose

[6]In the case of the WIC program, a woman's first visit lasts a maximum of an hour, and almost all of that time must of necessity be devoted to explanations of the use of the WIC food vouchers. When she returns a month later, the greater part of the time is again usually devoted to explaining the vouchers. The CSFP program focuses on the preparation of the surplus foods distributed to recipients.

children died in the first month after birth during 1977 to 1978, only 30 percent received adequate prenatal care. Miller urged that in the future as many as possible be located and assisted.

To summarize, we have seen that

- o D.C. has an unusually high percentage of very-low-birthweight infants;
- o Nearly one out of two of these infants dies;
- o If the incidence of VLBW babies can be lowered, the District's infant mortality rates would improve significantly;
- o A cluster of factors, including early and continuous prenatal care, adequate nutrition, and the absence of smoking, alcohol, and drug abuse, appears to be associated with higher birth weights.

Possibilities for an Outreach Program to Prevent Prematurity in the District

An aggressive outreach program, targeted to specific geographic areas whose residents have a high incidence of prematurity, and staffed mainly by community residents, could identify high-risk mothers, bring them into the system, and encourage them to follow preventive practices.

Although the reasoning on which it is based is understandable, the District's lack of an aggressive outreach program to prevent prematurity appears to many observers to be a serious flaw. Miller (1981) interviewed a number of experts who served on the Mayor's Blue Ribbon Committee and on the

current Mayor's Advisory Council on Maternal and Child Health and was told that while some high-risk pregnancies would be missed in any prenatal screening program, sufficient numbers would be identified to justify the effort.

A preventive approach might do well to be very broad based. In addition to preventive medical services, it should incorporate nutritional supplements, family planning services, and social service counseling. Each woman's key needs should be determined by a qualified professional so that attention could be focused on these needs, thus making the best use of staff and financial resources, both of which are scarce at present.

But before pregnant women at risk can be identified and assisted, they have to be brought into the system. How can this be done? One practical approach would be to identify specific small geographic areas with high concentrations of infant mortality (such areas have already been identified by District analysts) and train a small group of community residents to locate, identify, counsel, and remain in close touch with women at risk in these areas from as early in their pregnancies as possible through their children's first year of life. The community outreach workers could themselves be identified, trained, and supervised by a professional, perhaps a public health nurse, possibly assisted by a social worker experienced in mother/child relations.

The problem with many outreach efforts in prevention is that they rely exclusively on costly professionals, most or all of whom are outsiders coming into a high-risk community. Yet many of their functions do not need to be performed by professionals. The approach suggested here would rely heavily on women residing in the community, women who had themselves borne children and were personally familiar with the problems faced by low-income mothers. These outreach workers could be a vital front line of attack. Together, the outreach workers and the professional could tap community resources, including churches and civic organizations, to help identify high-risk mothers. They could explain the need for prenatal care. The community workers could accompany high-risk mothers to the clinics. They could reinforce preventive measures advised for the mothers. They could help the mothers locate and qualify for various nutritional supplemental programs such as WIC and CSFP.

These workers could also continue to counsel the mothers after they had given birth. As stated in the section on "Recent Efforts to Lower the District's Infant Mortality Rate," the District's mortality rate for other than white infants in the second to twelfth month of life (the postneonatal period) rose (by 16 percent) between 1970 and 1978 while simultaneously declining (by 23 percent) for black babies nationally (Appendix

Table A-6). An example of the kind of post-birth counseling needed by some low-income mothers comes in a public health nurse's report of visits to 32 new District mothers identified as needing special follow-up. Five of the 32 were preparing their babies' formulas incorrectly -- typically by adding extra water to "stretch" it and so make it last longer -- and consequently giving the infants inadequate food.

A study published in the fall of 1982 (Boone, 1982) provides some remarkable insights into special factors behind high-risk births in the District of Columbia. Boone studied 210 D.C. residents who gave birth during 1977 and 1978 at D.C. General Hospital, the city's public hospital. Of these women, 105 gave birth to VLBW infants weighing 1500 grams or less. The other 105 were a matched control group whose babies were of normal weight. Out of 77 live VLBW births, 55 infants died in their first year of life. The infant mortality rate for the VLBW group thus was 714.[7] The infant mortality rate for the control group was zero.

What makes this study of particular interest is the nature of the population analyzed. These women were all D.C.

[7]Nearly every reviewer who read this paper in draft asked me if this infant mortality rate of 714 was correct. It is.

residents, all disadvantaged, all giving birth in the same public hospital. Remarkably, the variables distinguishing the VLBW mothers from the mothers of normal-weight infants were not what would been expected from previous low-birth-weight research. That is, they were not distinguished by marital status, not by age, and not by education. Nor, quite surprisingly, did heroin and methodone addiction distinguish the two groups.

Boone, the study's author, wrote (on page 233) that:

"Results suggest...that the disadvantaged Black woman at highest risk

(1) is underweight;

(2) tends to abuse nicotine and alcohol;

(3) is an ineffective contraceptor;

(4) has frequent, closely spaced pregnancies;

(5) has a continuing history of poor pregnancy outcome;

(6) was not born in the District of Columbia, but is a migrant from a southern state; and

(7) has some other chronic medical condition or poor general health."

Some of Boone's findings are presented in Table 4.

Boone also formed certain hypotheses based on interviews with a small number of the VLBW mothers. She noted that the

Table 4
Comparison of disadvantaged black mothers with infants of normal birth weight with disadvantaged black mothers with infants of very low birth weight (District of Columbia residents, 1977-1978)[1]

Characteristics	Mothers of infants with Normal birth weight	Very low birth weight
Not significant		
Unmarried	79.5%	76.4%
Age at delivery (mean)	22.6 yrs.	23.2 yrs.
Years of education (mean)	10.9 yrs.	10.8 yrs.
History of street drug abuse	25.7%	29.5%
Significant		
Sought prenatal care during pregnancy	92.9%	77.0%
Hypertension history	10.5%	20.2%
Resident in census tracts closest to the hospital at delivery	11.4%	25.7%
Born outside Washington	42.9%	58.1%
Smoker	44.0%	60.9%
Alcoholic	1.1%	11.5%
Number of previous infant deaths (mean)	.05	.17
Number of previous therapeutic abortions (mean)	.25	.56
Number of previous miscarriages (mean)	.22	.48

[1]Total sample size was 105 mothers of normal birth weight infants and 105 mothers of very low birth weight infants (1,500 grams or less), giving birth at D.C. General Hospital.

Source: Boone, Margaret S.: "A Socio-Medical Study of Infant Mortality Among Disadvantaged Blacks." Human Organization 41:227-236, 1982.

mothers tend "...toward psychological depression because of poor primary relationships...[and tend] to have few regular, institutionalized, or culturally determined forms of social support [p. 233]." The picture of the mother at very high risk that is suggested by Boone's research is a tragic one. She wasn't born in the District of Columbia; she doesn't have many people to help her; she often smokes; she may drink, sometimes heavily; she sometimes has no prenatal care of any kind; when she tries she is unsuccessful in controlling her fertility; she has had abortions, miscarriages, or even previous infant deaths.

A common argument advanced against the prevention approach is that it is extremely costly. If one looks specifically at the District, it is not difficult to imagine a remarkably low-cost prevention outreach and assistance program. If it were targeted by geographic area, limited to women with very low incomes and who were selected by carefully defined criteria as being at high risk, it should be possible to limit the program to relatively small numbers of women, particularly since the entire city averages less than 10,000 births to residents a year. In view of the high cost of medical treatment, a program to prevent prematurity that met with even modest success would more than repay the investment.

There would be other benefits that to many would far outweigh cost savings. If such a program were successful, it would save lives. It would prevent some infants being born with major handicaps. It would reduce child abuse. It would save parents and infants untold anguish. And it would introduce needed health care information into the community network.

Call for a Policy of Preventing Prematurity

A policy of preventing prematurity has the potential to further reduce infant mortality in the District of Columbia, improve the quality of life for newborns and their families, and save public and private funds.

For such a policy to realize its potential, all segments of the community will need to cooperate with one another in a coordinated fashion. The District needs:

- a commitment to the concept of preventing prematurity;
- a long-range plan that brings together the public and private sector;
- a single, full-time, senior official, who has the full confidence of the Mayor and the Commissioner of Public Health, to lead and coordinate a city-wide preventive program; and
- a pilot outreach program along the lines described in the preceding section, funded for three years (if it

is successful it will be highly cost effective and should be continued indefinitely).

The District cannot do this alone. It will need the wholehearted cooperation of medical professionals, of church, civic, and other citizens' groups, of teachers, of voluntary agencies, of the media, and of the public at large. And together all of us will need to seek and win the wholehearted cooperation of high-risk mothers.

It is important not to make grandiose claims for a preventive approach. Women under the pressures of poverty and loneliness are understandably slow to change their health habits. But, according to the available research findings, prevention can be expected to yield some success. Whenever a small success saves a life, it becomes large indeed.

In his novel Guard of Honor, James Gould Cozzens observed about human nature:

> The operation of man is habit, and the habit of habit is inertia. This weight is against every human endeavor; and always the best bet is, not that a man will, but that he won't.

This need not be true here. With serious, coordinated efforts to prevent prematurity, with thoughtful, dedicated leadership, we can further reduce infant mortality in the District of Columbia.

Appendix Tables

and

Select Bibliography

Table A-1
Live births and infant deaths[1]
linked by race and birth weight
(infants born in 1979 to District of Columbia residents)

	All races	Whites	Blacks
Total live births	9,475	1,349	8,126
Total infant deaths	205	8	197
Infant mortality rate[2]	21.6	5.9	24.2
Total births between 1,501-2,500 grams	951	67	884
Linked infant deaths	29	2	27
Infant mortality rate for low birth weight babies	30.5	29.9	30.5
Total births under 1,501 grams	261	6	255
Linked infant deaths	124	1	123
Infant mortality rate for very low birth weight babies	475.1	166.7	482.4

[1]Infants who died before reaching one year of age.
[2]Deaths in the first year of life per 1,000 live births.

Source: Research and Statistics Division, Office of Policy and Planning, Department of Human Services, District of Columbia, unpublished data.

Table A-2
Comparison of infant mortality rates[1]
among blacks and whites in the United States
(selected years, 1960-1978)

Year	Total	Black	White
1960	26.0	44.3	22.9
1965	24.7	41.7	21.5
1970	20.0	32.6	17.8
1975	16.1	26.2	14.2
1976	15.2	25.5	13.3
1977	14.1	23.6	12.3
1978	13.8	23.1	12.0
1979	13.0	—	—

[1]Deaths in the first year of life per 1,000 live births.

Source: The Select Panel for the Promotion of Child Health: Better Health for our Children: A National Strategy. Volume III: A Statistical Profile. (p. 129) DHHS (PHS) Pub. No. 79-55071. Public Health Service. Washington. U.S. Government Printing Office. 1981.

Table A-3
Comparison of births, infant deaths, and infant mortality rates[1] among blacks and whites
(District of Columbia residents, 1970-1981)

Year	Black			White			White births as % of total births
	Total births	Infant deaths	Infant mortality rate[1]	Total births	Infant deaths	Infant mortality rate[1]	
1970	13,091	389	29.7	1,869	43	23.0	12%
1971	12,131	368	30.3	1,783	28	15.7	13%
1972	10,518	296	28.1	1,368	27	19.7	12%
1973	9,413	245	26.0	1,424	31	21.8	13%
1974	8,737	255	29.2	1,300	22	16.9	13%
1975	8,462	254	30.0	1,284	25	19.5	13%
1976	8,293	230	27.7	1,342	10	7.5	14%
1977	8,515	251	29.5	1,370	19	13.9	14%
1978	8,004	229	28.6	1,368	13	9.5	15%
1979	8,053	199	24.7	1,350	8	5.9	14%
1980	7,884	210	26.6	1,373	18	13.1	15%
1981	7,749	196	25.5	1,583	22	14.1	17%

[1]Deaths in the first year of life per 1,000 live births.

Source: Research and Statistics Division, Office of Policy and Planning, Department of Human Services, District of Columbia.

Table A-4
Infant mortality rates[1] according to race in the United States, compared with those in the District of Columbia and with those in selected cities (1978)

Cities	Total	Whites	Other Races
U.S.	13.8	12.0	21.1
D. C.	27.3	13.4	29.7
Baltimore	23.2	20.0	24.8
Boston	16.6	13.1	21.4
Chicago	21.3	15.3	26.6
Dallas	16.3	12.4	22.2
Detroit	22.3	15.4	25.3
Houston	15.6	13.3	20.3
Jacksonville	14.5	13.5	16.7
Los Angeles	14.4	12.4	19.4
Memphis	16.0	14.4	17.0
New Orleans	22.2	16.1	24.5
New York	16.0	13.1	20.4
Philadelphia	18.2	15.2	21.1
Pittsburgh	15.0	11.2	23.3
San Antonio	13.4	12.3	25.6
St. Louis	22.5	13.0	28.8

[1]Deaths in the first year of life per 1,000 live births.

Source: National Center for Health Statistics.

Table A-5
Comparison of live births in the United States and in the District of Columbia, according to race and birth weight (1970-1979)

		US total[1]	DC total	US black	DC black	US white	DC white
1979:	2500 g or less	—	—	12.55	14.04	—	—
	1500 g or less	—	—	2.37	2.80	—	—
1978:	2500 g or less	7.11	9.93	12.85	10.79	5.94	5.53
	1500 g or less	1.17	3.13	2.43	3.52	0.91	1.22
1977:	2500 g or less	7.07	10.60	12.79	11.70	5.93	5.72
	1500 g or less	1.13	2.75	2.38	3.00	0.89	1.51
1976:	2500 g or less	7.26	9.50	12.97	10.30	6.13	5.64
	1500 g or less	1.15	2.45	2.40	2.67	0.91	1.28
1975:	2500 g or less	7.39	9.74	13.09	10.70	6.26	3.90
	1500 g or less	1.16	2.68	2.37	2.89	0.92	1.60
1974:	2500 g or less	7.42	11.38	13.14	12.21	6.30	6.60
	1500 g or less	1.14	2.21	2.27	2.35	0.92	1.23
1973:	2500 g or less	7.55	11.02	13.25	11.81	6.41	6.86
	1500 g or less	1.16	2.15	2.28	2.30	0.94	1.43
1972:	2500 g or less	7.67	10.48	13.58	11.29	6.49	4.98
	1500 g or less	1.18	2.16	2.38	2.26	0.94	1.66
1971:	2500 g or less	7.66	10.07	13.35	11.00	6.57	4.62
	1500 g or less	1.14	2.55	2.29	2.83	0.92	0.05
1970:	2500 g or less	7.94	10.43	13.86	10.86	6.84	7.82
	1500 g or less	1.17	2.21	2.40	2.41	0.95	1.08

[1] Includes all other races not shown separately.

NOTE: National figures for 1970 and 1971 are based on a 50-percent sample; for 1972-78, they are based on 100 percent of births in selected states and on a 50-percent sample of births in all other states. Percentages are based only on records for which characteristic is stated. D.C. figures are based on 50 percent of births for which characteristic is stated.

SOURCE: U.S. figures - 1979: computed by Division of Analysis from data compiled by Division of Vital Statistics, National Center for Health Statistics; 1970-1978: Health, United States, 1981. DHHS Pub. No. (PHS) 82-1232. Public Health Service. Washington. U.S. Government Printing Office. December, 1980.

D.C. figures - 1978-1979: Division of Vital Statistics, National Center for Health Statistics, unpublished data.
1970-1977: Monthly Vital Statistics Reports, Public Health Service. Washington. U.S. Government Printing Office.

Table A-6
Comparison of infant, neonatal, and postneonatal mortality rates for nonwhites in the District of Columbia and for blacks in the United States (1970-1978)

	Infant mortality rates[1]		Neonatal mortality rates[2]		Postneonatal mortality rates[3]	
	D. C. nonwhites	U.S. blacks	D. C. nonwhites	U.S. blacks	D. C. nonwhites	U.S. blacks
1978	29.7	23.1	21.8	15.5	7.9	7.6
1977	29.7	23.6	22.3	16.1	7.5	7.5
1976	28.0	25.5	23.0	17.9	5.0	7.6
1975	30.1	26.2	23.8	18.3	6.3	7.9
1974	27.6	26.8	20.9	18.7	6.8	8.1
1973	25.5	28.1	19.2	19.3	6.3	8.8
1972	28.5	29.6	20.8	20.7	7.7	8.9
1971	29.8	30.3	22.2	21.0	7.5	9.4
1970	29.5	32.6	22.7	22.8	6.8	9.9

[1]Deaths in the first year of life per 1,000 live births.
[2]Deaths in the first 28 days of life per 1,000 live births.
[3]Deaths in the 29th day of life through the 11th month of life per 1,000 live births.

Source: Computed in 1982 by Division of Analysis from data compiled by Division of Vital Statistics, National Center for Health Statistics.

Table A-7
Infant mortality and morbidity, according to birth weight, for selected areas of the United States (1974-1975)

	Rate per 1,000 live births	
	Birth weight 2,500 grams or less	Birth weight Over 2,500 grams
Neonatal mortality	102.8	2.7
Postneonatal mortality	16.6	3.2
Severe developmental delay or congenital anomalies	210	128
Significant illness	222	167

Source: National Center for Health Statistics: "Trends and Variations in Birth Weight" by Joel C. Kleinman. Health, United States, 1981. (p. 8) DHHS Pub. No. (PHS) 82-1232. Public Health Service. Washington. U.S. Government Printing Office. Hyattsville, Maryland. December 1981.

Table A-8
Infant mortality rates[1], according to prenatal care, for infants born in 1979 to District of Columbia residents

Prenatal Care	Live Births	Infant Deaths	Infant Mortality Rates
Adequate Care	3,343	39	11.7
Intermediate Care	2,473	42	17.0
Inadequate Care	869	33	38.0
No Care	235	12	51.1
Unknown Care	2,555	79	30.9
Total	9,475[2]	205	21.6

Adequate care: Less than 15 weeks pregnant at first prenatal visit and 10 or more visits; or, weeks pregnant at first prenatal visit not known and 10 or more visits.

Intermediate care: Less than 15 weeks pregnant at first prenatal visit and 5-9 visits; or, 15-28 weeks pregnant at first prenatal visit and 5 or more visits; or, weeks pregnant not known at first prenatal visit and 5-9 visits.

Inadequate care: Less than 15 weeks pregnant at first prenatal visit and less than 5 visits; or, 15-28 weeks pregnant at first prenatal visit and less than 5 visits; or, 29 or more weeks pregnant at first prenatal visit and any number of visits; or, weeks pregnant not known at first prenatal visit and under 5 visits; or, 29 and over weeks pregnant at first prenatal visit and number of visits not known.

No care: No visits.

Unknown care: No entry for either item; or, less than 29 weeks pregnant at first prenatal visit and number of visits unknown.

[1]Deaths in the first year of life per 1,000 live births.
[2]Includes late filed birth certificates.

Source: Research and Statistics Division, Office of Policy and Planning, Department of Human Services, District of Columbia.

Table A-9
Infant mortality rates[1] (IMR) for mature and immature babies born to married and unmarried mothers (District of Columbia, 1970, 1979)

	1970	1979
IMR for all babies		
Born to married women	22.4	14.6
Born to unmarried women	30.6	26.8
IMR for babies of normal weight		
Born to married women	8.5	5.0
Born to unmarried women	9.3	6.9
IMR for babies of low birth weight		
Born to married women	129.7	108.9
Born to unmarried women	144.3	133.4

[1]Deaths in the first year of life per 1,000 live births.

Source: Research and Statistics Division, Office of Policy and Planning, Department of Human Services, District of Columbia.

Table A-10
Comparison of live births, according to race and prenatal care, in the U. S. and in D.C. (1970-1978)

Prenatal care began	US total[1]	DC total	US black	DC black	US white	DC white
1978: 1st trimester	74.9	58.0	60.2	55.4	78.2	70.8
3rd trimester or none	5.4	14.6	9.3	15.4	4.5	10.8
1977: 1st trimester	74.1	59.9	59.0	57.9	77.3	70.5
3rd trimester or none	5.6	13.5	9.6	13.7	4.7	11.9
1976: 1st trimester	73.5	59.7	57.7	57.2	76.8	73.5
3rd trimester or none	5.7	15.0	9.9	15.9	4.8	10.5
1975: 1st trimester	72.4	54.0	55.8	53.4	75.9	74.4
3rd trimester or none	6.0	14.7	10.5	16.0	5.0	7.3
1974: 1st trimester	72.1	54.7	53.9	51.3	75.9	73.7
3rd trimester or none	6.2	13.6	11.4	14.5	5.1	9.0
1973: 1st trimester	70.8	49.9	51.5	46.9	74.9	66.4
3rd trimester or none	6.6	16.0	12.4	17.2	5.3	10.2
1972: 1st trimester	69.5	47.3	49.0	43.9	73.6	67.9
3rd trimester or none	6.9	17.3	13.3	18.6	5.6	10.5
1971: 1st trimester	68.6	44.1	46.6	40.1	72.9	64.8
3rd trimester or none	7.3	19.3	14.6	20.7	5.8	11.9
1970: 1st trimester	68.0	39.7	44.4	37.3	72.4	60.5
3rd trimester or none	7.9	21.5	16.6	23.9	6.2	14.0

[1] Includes all other races not shown separately.

NOTE: National figures for 1970 and 1971 are based on 50-percent sample; for 1972-1978, they are based on 100 percent of births in selected states and on a 50-percent sample of births in all other states. Percentages are based only on records which show prenatal care status. D.C. figures are based on 50 percent of births which show prenatal care status.

Source: U.S. figures - Health, United States, 1981. DHHS Pub. No. (PHS) 82-1232. Public Health Service. Washington. U.S. Government Printing Office, December, 1981.

D.C. figures -1978: Division of Vital Statistics, National Center for Health Statistics, unpublished data; 1970-1977: Monthly Vital Statistic Reports, Public Health Service. Washington. U.S. Government Printing Office.

Table A-11
Percentage of total live births for which prenatal care was reported (District of Columbia, 1970-1978)

	Percentage of total births for which prenatal care was reported[1]		
	Total	Black	White
1978	74	72	82
1977	70	69	76
1976	69	68	70
1975	74	74	79
1974	74	73	82
1973	67	66	74
1972	80	78	89
1971	80	78	90
1970	80	76	87

[1] Includes report of "no prenatal care."

Source: 1978: Division of Vital Statistics, National Center for Health Statistics, unpublished data.

1970-1977: Monthly Vital Statistics Reports, Public Health Service. Washington. U.S. Government Printing Office.

Table A-12
Live births and infant deaths[1] linked
by race and birth weight (infants born
to New York City residents in 1979)

	All races	White	Black	Other non-white
Total live births[2]	101,591	60,120	35,724	5,747
Total infant deaths[2]	1,478	729	692	57
Infant mortality rate[3]	14.55	12.13	19.37	9.92
Total births 1,501-2,500 grams	7,751	3,613	3,815	323
Linked infant deaths	238	125	102	11
Infant mortality rate[3] for low birth weight babies	30.71	34.60	26.74	34.06
Total births under 1,500 grams	1,567	652	871	44
Linked infant deaths	652	298	332	22
Infant mortality rate[3] for very low birth weight babies	416.08	457.06	381.17	500.00

[1]Infants under one year of age who were born in 19[illegible] and died in either 1979 or 1980.
[2]Includes infants whose birth weight was not [illegible]
[3]Deaths in the first year of life per 1,000 b[illegible]

Source: Office of Biostatistics, Office of Public Health, Department of Health, State of New York, Albany, New York.

Table A-13
Live births and infant deaths[1] linked
by race and birth weight (infants born to
North Carolina residents in 1980)

	All races	White	Nonwhite[2]
Total live births	84,481	57,286	27,195
Total infant deaths	1,137	626	511
Infant mortality rate[3]	13.5	10.9	18.8
Total births 1,501-2,500 grams	5,461	2,889	2,572
Linked infant deaths	167	109	58
Infant mortality rate[3] for low birth weight babies	30.6	37.7	22.6
Total births under 1,500 grams	1,248	599	649
Linked infant deaths	550	256	294
Infant mortality rate[3] for very low birth weight babies	440.7	427.4	453.0

[1]Infants under one year of age who were born in 1980 and died in either 1980 or 1981.
[2]92 percent black; 4 percent American Indian; 4 percent all other.
[3]Deaths in the first year of life per 1,000 live births.

Source: State Center for Health Statistics, Division of Health Services, State of North Carolina, Raleigh, North Carolina.

Table A-14
Live births and infant deaths[1] linked by race and birth weight (infants born to Michigan residents in 1979)

	All races[2]	White	All other[3]
Total live births	144,452	118,671	25,575
Total infant deaths	1,882	1,310	570
Infant mortality rate[4]	13.0	11.0	22.3
Total births 1,501-2,500 grams	8,401	5,696	2,693
Linked infant deaths	298	217	80
Infant mortality rate[4] for low birth weight babies	35.5	38.1	29.7
Total births under 1,500 grams	1,777	1,134	641
Linked infant deaths	830	540	290
Infant mortality rate[4] for very low birth weight babies	467.1	476.2	452.4

[1]Infant deaths are infants under one year of age who were born in 1979 and died in either 1979 or 1980.
[2]Race not stated included only in totals.
[3]96 percent black; 2 percent American Indian; 2 percent other races.
[4]Deaths in the first year of life per 1,000 live births.

Source: Vital Statistics Unit, Department of Public Health, State of Michigan, Lansing, Michigan.

Table A-15
Comparison of infants born of low birth weight (LBW) and very low birth weight (VLBW) to residents of the District of Columbia, New York City, North Carolina and Michigan (1979-1980)

	Total births	Infants 1,501-2,500 grams (LBW)	LBW (% of total)	Infants 1,500 grams and under (VLBW)	VLBW (% of total)
District of Columbia[1]	9,475	951	10	261	3
New York City[1]	101,591	7,751	8	1,567	2
North Carolina[2]	84,481	5,461	6	1,248	1
Michigan[1]	144,452	8,401	6	1,777	1

[1] Infants born in 1979.
[2] Infants born in 1980.

Source: Tables A-1, A-12, A-13, A-14.

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